> "We ourselves did try a form of usury law, but with the natural result. It was evaded wholesale by necessitous debtors, and the simple device was adopted of tacking on the prohibited interest to the original loan. . . . A native ruler of the old type would probably begin by putting half a score of usurers to death by slow torture; but this is not our way, nor would it in this case do much good except to check money-lending for a season. We are on the horns of a dilemma. We believe in the sanctity of contract, but we loathe Shylock, and writhe at seeing the peasant come shorn out of his clutches."

As an interesting and clear account of these and innumerable other questions affecting the welfare of the people, Mr. Crooke's book is greatly to be commended. The stay-at-home Englishman is, and always has been, inclined to lay down some system of theoretical perfection for the government of our great Eastern dependency. He will learn here that there are too many causes of friction—the opposing interests and prejudices of different religions, different races, and different castes—to admit of any perfectly smooth working of the great machine of Government. For the sake of peace and practical expediency it is necessary to yield a little here and a little there, and to moderate the rate of progress to suit the conditions of the case.

A really weak point in an otherwise altogether admirable work is that portion of Chapter ii. which deals with the history of the province from the earliest times down to the Muhammadan conquest. Mr. Crooke has not consulted the latest authorities on this subject; and in not doing so, he has made a mistake which is all the more serious because, as it happens, the study of inscriptions and coins has, within the last few years only, brought to light a very considerable amount of historical information. Very few of the dates for the earliest period given by Mr. Crooke are accepted by scholars nowadays. The initial year of the Gupta era is, for instance, no longer regarded by any one as lying between the years 160 and 170 A.D. For this statement Mr. Crooke quotes Mr. Vincent Smith: "the most recent authority on the gold coinage of the Guptas." Mr. Vincent Smith is still entitled to this designation; but, between the date of the work to which Mr. Crooke refers and the date of publication of Mr. Crooke's book, he has contributed a number of articles to learned periodicals, in which he has accepted the years 319-20 A.D. as the starting-point of the Gupta era Again, a great deal more is known now about the different Scythic invasions of Northern India and their dates than would be inferred from Mr. Crooke's account. In a word, this portion of the book—unimportant though it may be from the author's point of view—is altogether unsatisfactory, and should be entirely rewritten in a new edition.

It remains only to notice that the work is admirably printed, bound, and illustrated.

CHEMICAL EQUILIBRIUM.

The Phase Rule. By Wilder D. Bancroft. Pp. viii + 255. (*The Journal of Physical Chemistry*, Ithaca, New York, 1897.)

IN the preface to this book the author says:—

> "My idea is that all qualitative experimental data (referring to chemical equilibrium) should be presented as particular applications of the Phase Rule and the Theorem of Le Chatelier, while the guiding principles for the classification of quantitative phenomena should be the Mass Law and the Theorem of van 't Hoff. In this book I have tried to present the subject of qualitative equilibrium from the point of view of the Phase Rule and of the Theorem of Le Chatelier, without the use of mathematics."

Notwithstanding the thoroughness with which this programme has, on the whole, been carried out, the writer cannot help feeling that the result is not completely satisfactory, and that this is largely due to the narrow treatment rendered necessary by the limitations which the author has imposed on himself. The phase rule itself merely gives the connection between the number of components of a system, the number of phases, and the number of external factors of equilibrium (pressure and temperature usually) on the one hand, and the number of independently variable factors of equilibrium on the other. It gives no further information about the system whatever. The theorem of Le Chatelier permits us to predict the direction in which the equilibrium will be displaced by a change in one of the factors of equilibrium. A study of chemical equilibrium from this limited point of view, almost of necessity resolves itself into an enumeration of the different possible cases (as, for example, a system containing one component and one phase, which may be liquid, solid, or gaseous; a system containing one component and two phases, and so on, considering in turn systems containing two, three, or more components), together with a description of the special cases which have been investigated, in so far as they illustrate the two guiding principles above mentioned. This is, on the whole, the plan adopted by the author, and his discussion of many possible cases of which no actual example has been investigated, will be of much service in indicating profitable lines for research.

The equilibria between solids and solutions, and between two solutions are very fully treated; whilst the dissociation of calcium carbonate and of ammonium chloride are the only ones of their kind mentioned, equilibria in homogeneous gaseous or liquid systems are omitted, and the metallic alloys receive somewhat scanty attention. Some of these omissions are doubtless due to the fact that the study of the cases in question is not materially assisted by the application of the phase rule.

The distinction which is made between solvent and dissolved substance (for which latter the author adopts the not very euphonious term "solute") appears to the writer to be purely conventional, and not, as Prof. Bancroft seems to think, a real difference. On pp. 36 and 37 we read:—

> "In cases of limited miscibility there is no difficulty in telling which component is solvent and which solute; but when the two substances are consolute (miscible in all proportions), there is at present no sure way of deciding at what concentration the change takes place."

The introduction of a conception which is incapable of more accurate definition than the foregoing, can and does only obscure the subject. The distinction of solubility from fusion curves and the consequent differentiation of eutectic alloys from cryohydrates, seems to the writer to be unnecessary and undesirable. On p. 127 there is

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a curious discussion as to whether liquids which are miscible in all proportions are, or are not, mutually infinitely soluble. A clear definition of solubility, which is nowhere to be found in the book, would have made this impossible.

A little more care bestowed on the literary workmanship of the book would have made it much more attractive, and saved the reader both time and trouble. For example, he is left to guess what quantities are taken as ordinates and abscissæ of several of the curves; frequently, also, a curve is referred to without any indication of the diagram on which it is to be found; this is perplexing when, as on p. 49, the diagram is finally discovered eleven pages further back. The English, too, is not always above reproach. On p. 51 we read, for example: "If instead of diminishing the pressure upon a saturated solution reaching the divariant system, solid solute and vapour, we increase it," &c. Abrupt, not to say discourteous, criticism, such as the following (from p. 158), is also to be deprecated in a serious scientific work:—

> "Étard has stated that the line O F terminates at the melting point of the more fusible salt. This is entirely wrong. The curve O F terminates at the temperature of the eutectic alloy formed from the two salts, a temperature which is necessarily lower than the melting point of potassium nitrate. Curiously enough, Étard has an inkling of the truth in one case, but it is not sufficient to make him modify his erroneous hypothesis."

The writer would not have dwelt on these comparatively trivial faults at such length were it not that the book contains much that is valuable. The numerous references to the newer work on the subject (and that is by far the greater part of it) will be of great service to any one desiring to make a more profound study of the problems of heterogeneous equilibrium. T. E.

EAST INDIAN BEES AND WASPS.

The Fauna of British India, including Ceylon and Burma. Edited by W. T. Blanford, F.R.S. (Published under the authority of the Secretary of State for India in Council.)

Hymenoptera. Vol. i. Wasps and Bees. By Lieut.-Colonel C. T. Bingham. 8vo. Pp. xxix + 579; 188 woodcuts, 4 coloured plates. (London: Taylor and Francis, 1897.)

THE first of the volumes before us is one of a series that is being produced under the authority of the Secretary of State for India, in order to diffuse knowledge already obtained and to facilitate the acquisition of further information. The book is the twelfth volume of the series, which was commenced in 1888 by the issue of a volume on the Mammals, written by Dr. W. T. Blanford, F.R.S., who is also the editor of the series. The entomology of India has been hitherto too much neglected, and the literature is very scattered and fragmentary; indeed, until quite recently it has not been possible to ascertain even the names of the locusts that from time to time devastate various parts of India. Our thanks are therefore due to those who are endeavouring to remedy this state of affairs. Four volumes on Lepidoptera have already appeared in the series. Though butterflies and moths are the special favourites of the Insect world with British entomologists, they are by no means the most important insects either from a scientific or an economic point of view, and the editor of the series has done well to break fresh ground with this volume on the bees and wasps, even though it cannot be expected that the work shall prove an exhaustive one. We are glad to find that the venture is a successful one, especially as very serious difficulties, arising from the incompleteness of collections of these insects and their inadequate nomenclature, have had to be encountered.

Colonel Bingham, the author of the second volume under notice, has an extensive acquaintance with the insects he describes, gained during many years of work as Conservator of Forests in India. The volume does not include the ants and the ruby-flies, but, with these exceptions, comprises the most important of the Hymenoptera, and includes just about 1000 species. It is chiefly devoted to descriptions and to tables by which the names of the species may be ascertained. As this work will necessarily be, for some time to come, the standard one on the aculeate Hymenoptera of India, it was necessary that nomenclature and classification should be thoroughly dealt with. These points are satisfactory, the descriptions being concise and clear, and the classification and nomenclature up to the level of the best and latest work. Now that the naturalists of India have this valuable volume to aid them in the preliminary work of finding out the names of the stinging Hymenoptera they meet with, we may hope that attention may be given to their habits and instincts. The fossorial Hymenoptera occupy considerably more than half the present volume; their habits are varied in details and of extreme interest, so that a large field is here opened to the observing naturalist. The fact that these insects are many of them able to sting the victims they carry off and store as food for their young, in a manner that would be creditable even if they had a perfect knowledge of anatomy, is now, thanks to the labours of Fabre and others, generally known.

It is not, however, known to more than a few that in one group of Fossors—the Ampulicides—the members have the still more inexplicable power of merely taking their prisoners captives, and making them march to the spot where they are to be immured and eaten. Colonel Bingham tells us that "these beautiful insects are predatory on cockroaches. In Burma I have frequently seen these wasps come into the house and search for their prey under boxes and furniture. In the forest once I watched a rather large specimen of *A. compressa*, Fabr., struggling with a huge cockroach; the latter was either paralysed by a sting, or dazed with fear, and was being half dragged by an antenna and foreleg, half hustled and pushed along by the active little wasp."

Although the number of species in this volume (about 1000, as we have previously stated) may appear to those unacquainted with entomology to be large, yet the volume in this respect is probably far from complete. Indeed, it is not improbable that the aculeate Hymenoptera of India will be found to number 2000 species; and now that this volume is available for the assistance

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